Nitrogen Rate for Irrigated Oats on Terminated Alfalfa

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Project Objective
To determine adequate N fertilization practices for irrigated oats on terminated alfalfa stubble.

Project Background
The major N release from crop residues on dryland is delayed until the second year because alfalfa roots extract soil moisture efficiently and dry out the soil. Irrigation removes this uncertainty. This demonstration was initiated to predict N application for oat production on alfalfa breaking under irrigation.

Demonstration Plan
The project was established at two sites in 2013 – a first year breaking with alfalfa terminated in spring with glyphosate and a second year alfalfa breaking with oats was sown on canola stubble. Two varieties – a milling variety, Triactor, and a forage variety, CDC Haymaker, were sown with zero tillage. The oats was fertilized with 0, 25, 50, 75, 100 and 125 kg N/ha at the time of seeding. The experimental design was a split plot design with varieties as main plots and fertilizer N rates as subplots, randomized and replicated four times. Forage yield was determined with a forage harvester at milk stage. Grain yield was determined after the oats ripened and the plots were swathed.

Demonstration Site
The demonstration was conducted in Outlook at the Canada-Saskatchewan Irrigation Diversification Center. The surface texture at the sites was sandy loam with 2.0% O.M.

Project Methods and Observations
The demonstrations were seeded May 24, forage yield was harvested on August 20 and the grain yield was taken on September 19. The field received 5.7 inches of rainfall from May to August, 2013. Forage and grain yield on first year of alfalfa breaking and second year of breaking also reflect impact of salinity on crop growth (Table 1).

Table 1: Oat N-Fertility on 1st Year and 2nd year of Alfalfa Breaking in 2013

Variety	1st Year Grain Yield	1st Year Forage Yield	2nd Year Grain Yield	2nd Year Forage Yield
	bu/ac	**t/ac**	**bu/ac**	**t/ac**
Triactor	248 a	9.8 a	187	5.8 a
Haymaker	184 b	8.8 b	165	6.7 a
LSD 0.05	7.8	0.4	NS	NS
N Applied				
(kg/ha)				
0	224	9.1	156 b	5.7 b
25	219	9.4	181 a	6.3 ab
50	210	9.6	181 a	6.5 ab
75	223	9.2	180 a	6.9 a
100	216	9.1	183 a	6.0 b
125	204	9.4	174 a	6.2 ab
LSD 0.05	NS	NS	17.4	0.8
Interaction				
LSD 0.05	NS	NS	NS	ND
CV (%)	8.0	7.8	9.7	ND

1 Means followed by the same letter at not significantly different at P = 0.05

The first year of breaking site is nonsaline whereas the second year of breaking site is moderately saline. Triactor yielded very well on the nonsaline site with nearly 250 bu/ac of grain and 10 ton/ac of forage. The forage harvest of both varieties occurred on the same day due to logistical constraints. CDC Haymaker yielded slightly less due to its slower development. There was no response in grain or forage yield to the nitrogen applications on the new alfalfa breaking. In contrast, the second year breaking showed yield response in grain and forage up to 25 lb N/ac. Further applications of N did not increase grain or forage yield. Increases in protein content were significant for the second year breaking demonstration.

Final Discussion
Grain yield responses to added nitrogen with oats did not occur on first year breaking alfalfa and were limited to 25 lb N/ac on second year breaking alfalfa. Forage yields increased to 50
lb N/ac on first year breaking and 75 lb N/ac on second year breaking. Nitrate levels were not determined on the forage samples, but based on the protein content in the grain, elevated levels are likely. Samples have been saved from the project for future analysis. Growers regularly report elevated levels of nitrate in green feed sown on alfalfa breaking.

This work supports the conclusions determined by Les Henry in the early 1980's. Irrigation of alfalfa breaking eliminates the need for nitrogen fertilizer on first year breaking.